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Landslide susceptibility analysis of Kuala Lumpur

ELANNI MD AFFANDI¹, NG THAM FATT^{1,*}, FERDAUS AHMAD², HELEN REEVES³,
VANESSA BANKS³, CHRISTIAN ARNHARDT³, ZAMRI RAMLI², QALAM A'ZAD ROSLE²,
JOY JACQUELINE PEREIRA⁴

¹ Department of Geology, Faculty of Science, University of Malaya, 50603, Kuala Lumpur, Malaysia

² Mineral and Geoscience Department, Malaysia, ³ British Geological Survey, Nottingham, United Kingdom

⁴ Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), UKM, Malaysia

* Corresponding author email address: thamfatt@gmail.com

Abstract: In the aspect of geophysical hazard in Kuala Lumpur, landslide and flood are two major natural disaster that have degrade the country in all ways. Numerous studies have been done locally to investigate the mechanism and nature of geophysical hazards. Landslide is considered a prominent geohazard in the country and worth RM 34 billion economic losses for the past 34 years. What is worse is the fact that most landslide in Malaysia occurred on man-made slope due to anthropogenic causes and can be mitigated if action is taken fast (Mahmud, 2013). With more ambitious development projects set for Kuala Lumpur in the next decade to support the urban innovation and city performance, mitigation of hazard and emphasis on disaster risk reduction is imperative to ensure the city's sustainability, prosperity and resilience are secured. This paper presents the method of landslide susceptibility analysis in Kuala Lumpur using bivariate statistical analysis by correlating the level of dependency of each class factor with landslide occurrence in Geographical Information System (GIS). The deliverable of this study is primarily to provide a suggested 5 ranking classification for spatial probability of occurrence (very low, low, moderate, high, very high) and does not convey information on the hazard and risk as well as the return periods.

Landslide inventory within Kuala Lumpur which become the primary input for this paper was prepared by compiling and organizing the relevant landslide occurrences from the Department of Mineral and Geoscience (JMG) and the Kuala Lumpur City Hall (DBKL). Data were retrieved from various sources such as satellite imagery, topographical maps, LiDAR data, geological data, reports and previous land use maps. Media reports were used to cross-check the landslide events and complete the spatial and temporal data. Fourteen parameters for landslide occurrence were analysed which covers topographical, hydrological and geological which include bedrock geology, surface geology, distance to lineament, distance to road, distance to streams, slope gradient, elevation, topographical position index, curvature, Normalized Difference Vegetation Index (NDVI), surface roughness, slope aspect, stream power index and topographical index. Statistical (qualitative) approaches are data-driven method

and rely on the functional relationships between known factors and the past landslide distribution (Guzzetti *et al.*, 1999). The individual parameters were compared to the landslide density map to obtain their relative importance that contribute to landslide occurrence. The weightage of each class is calculated based on landslide density occurrence of each class for every parameter.

The analysis showed 8.9% coverage of Kuala Lumpur classified as very high susceptible zone comprising of 524 landslide events (80.6%). The most relevant combination of parameter maps resulted in 88% of success rate. Cross validation technique done on the chosen map by subdividing it into 2 zones of alternating area whereby the first zone is tested and validated using weightage of the other zone which resulted to 88% and 85% of success rate for Zone A and Zone B respectively. The study will delineate landslide prone areas in support of city development and planning as well as disaster risk and reduction efforts. This research will help to refine the spatial forecasting ability of landslide disaster, improve slope management and land-use planning. Landslide inventory could be further improved by systematically collect data especially in terms of date, time and consistent record of landslide points and its type.

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